Cloud Computing and its Security in Higher Education

Asst. Prof. Rajendra V. Jadhav

Head of Department, Deartment Of Computer Science
Adarsh College,Vita
Tal:-Khanapur, Dist:-Sangli
Pin: - 416319, Maharashtra, India

Dr. Shivaji D. Mundhe

Director-MCA, Sinhgad Institute of Management and Computer Application,
S.No. 49/1, Off Westerly Bypass Pune-Mumbai Highway,
Narhe (Ambegaon), Pune -411 041

Abstract - Interest in cloud computing has seen a significant grouth in the past few years. The basic fact of this concept entails the reduction of in-house data centers and the delegation of a portion or all of the Information Technology infrastructure capability to a third party. This holds the promise of driving down cost while fostering innovation and promoting agility. Three typical kinds of cloud services are: Processing Clouds that provide scalable and mostly affordable computing resources that run enterprise programs, Storage Clouds that offer an alternative to local file systems, and Application Clouds that allow a thin client to interact with services that are completely hosted on an external infrastructure. Institutions of higher education, such as universities and colleges, are the core of innovation through their advanced research and development. Unfortunately, some of the limitations that confront such institutions are not the lack of ideas but rather repeated budget cuts, limited on-campus computing resources, lack of a unified storage media, and application that are scattered around campus computers. subsequently, universities may benefit greatly by significant power of cloud computing, including cost cutting as well as all the above types of cloud services. However, before full adoption, universities must consider key issues, which include, among others, migration tradeoffs and security. This paper explores the application of cloud computing in higher education and touches upon some of its aspired benefits as well as its expected limitations.

Keywords: Cloud Computing, Higher Education, Security, Software as a Service (SaaS), Computing Resources.

I. INTRODUCTION

Cloud computing is a recent concept that is still evolving across the information technology industry and academia. Several definitions have evolved so far, including one by the National Institute of Standards and Technology (NIST), which defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2009).Multiple research endeavors have been initiated to assess the aspired benefits that could be obtained by implementing cloud computing.

This paper addresses various aspects of computing requirements in general, and as applied to university settings in specific, and will attempt to tie these aspects to typical decision criteria to move to cloud computing,such as cost and security. The paper concludes with a set of recommendations and plans for future work..

II. THE CASE FOR CLOUD COMPUTING

Despite the fact that cloud computing is a relatively young concept with many questions still open, there is overwhelming consensus regarding the potential of this paradigm in advancing technology and providing new avenues for enterprises to explore that may cut cost and adopt better IT capabilities. Furthermore, new advanced network technologies make the move to cloud computing a logical choice (NIST,2009).

From a financial perspective, purchasing, installing, and maintaining extensive hardware for high-powered servers contribute to some of the higher budgets that universities are currently forced to allocate. This is paired with the soaring cost of licensing for the plethora of software packages that are scattered across campuses. In contrast, adoption of a cloud environment relieves the institution of the need to acquire an actual costly server in order to conduct research. Researchers are provided with the ability to leverage the "rent-by-the-hour" or "pay-as-you-go" concept to rent computing and storage horsepower such as Amazon's Elastic Cloud Computing (EC2), which claims to provide "resizable compute capacity in the cloud" (Amazon, 2009). The elasticity in a cloud service like EC2 provides a researcher with the advantage to rent exactly the capacity that they need with the ability to adjust it on a need basis, which is typically challenging and costly in case of in-house servers. The Electrical Engineering and Computer Sciences Department at the University of California at Berkeley had a first-hand dealing with this matter. They indicated that their lab "has benefited substantially from the ability to complete research by conference deadlines and adjust resources over the semester to accommodate course deadlines." As adopters of cloud computing, they "were relieved of dealing with the twin dangers of over-provisioning and under provisioning our internal datacenters."

Adoption of cloud computing permits significant savings in the area of supportive technologies, such as the massive air conditioning that is typically installed in university in-house server rooms in order to maintain a required level of temperature. Furthermore, there are additional savings that

could be achieved in terms of physical security requirements for such rooms, like fortified safes and advanced door locks. Complexity can be reduced with cloud computing. The varieties of disciplines that are inherent within a university learning environment impose the need for a variety of hardware and software platforms that are installed on campus. This contributes to the increase in the complexity of such platforms and adds to the already challenging tasks of IT administrators, including those that manage network and software. This can be even more detrimental with the budget cuts that affect the allocation of sufficient IT staff, thus overwhelming these administrators even further. The adoption of cloud computing is hoped to relieve these administrators from such burden. However, adoption has to be planned carefully as different applications make different usage of resources. For instance, a research endeavor that requires an extension crunching capability is more CPU a liberal arts application that requires the transmission of large amounts of multimedia data over the network and therefore requires large network bandwidth. Availability is a key matter in cloud computing since typical providers have established their services and associated resources in multiple data centers that are mostly located in different geographical locations. This builds location independence and supports the normally challenging tasks of disaster recovery and business continuity. Overall, any of the three flavors of cloud computing, namely processing clouds, storage clouds, and application clouds, offer benefits to institutions of higher education. However, there are also concerns that arise, sometimes even overshadowing these benefits, which is the subject of the following sections.

III. CONCERNS OVER ADOPTION

There are several obstacles computing faces before adopted. Following are the primary concerns are expressed in various levels

1. **Security:** there are several concerns surrounding the implementation of security in cloud computing is referred to the following section, which is dedicated to security, especially in a university setting.
2. **Performance and Availability:** experiments that are research endeavors computing power. Some of the concerns include how to guarantee such performance from an outside vendor. Availability of services is another related concern in terms of the possibility of massive vendor outages. This is especially true since student learning or the research results, which are typically tied to strict timelines. Extensive number CPU-bound than cloud servicing may, that cloud it can be widely in August concerns, IT personnel at here computing.
3. **Integration with In-Customizability:** University IT administrators typically use their own house applications with a portion that is customized to their own IT lab structure. A paramount concern is the transitioning of applications to the cloud environment and how much of the customizability will be lost in that process.
4. **Cost**: cost is another factor that may be introduced by additional vendor relationship management or possibly additional measures that are unique to cloud computing.
5. **SECURITY:** a primary concern that adopters have is the security of enterprise information. Data placed in can potentially be located in, and sent across the communication channels of different country, with potentially different data privacy laws, and therefore expose potentially sensitive data to the prying eyes of unauthorized individuals sense, this is not much different than the current outsourcing endeavors that tend to make such information available to various users and administrators in an offshore location, such as in the case of that are located in various countries Creeger (2009) indicates that the majority of intellectual property breaches typically result from internal attacks and therefore do not impact the decision whether or not to adopt cloud computing. On the other hand, in a higher education setting, this can become more challenging especially with research projects that address issues of national security or hospital patients' confidentiality. Security or hospital patients' confidentiality. This requires enough trust to be placed into the vendors, along with strict Service Level Agreements (SLAs), in order to safeguard such information and prevent intrusion and data theft. Integration of cloud security controls with university-wide departments and their various applications is another important challenge.. One concern is how seamless this integration can be and how effective it will be in maintaining the same level of information assurance of such applications, including their confidentiality, integrity, and availability. Application problem resolution and auditing are part of yet another challenge to the adoption of cloud computing. The main question is how available the application and system logs will be to campus IT administrators and support staff, who usually create their own in-house scripts in order to scrape such logs and resolve these problems.
   Finally, a major concern to universities is moving their data to an external provider. While such sites are likely equipped with state of the art disaster recovery and business continuity capabilities, they may become an attractive target for attackers since they would potentially host the data for multiple institutions rather than the isolated nature of research labs that are typically found in universities.
6. **A research conducted by the IDC Enterprise Panel (NIST, 2009) 2008 :** concluded that the primary concerns shown in Figure1

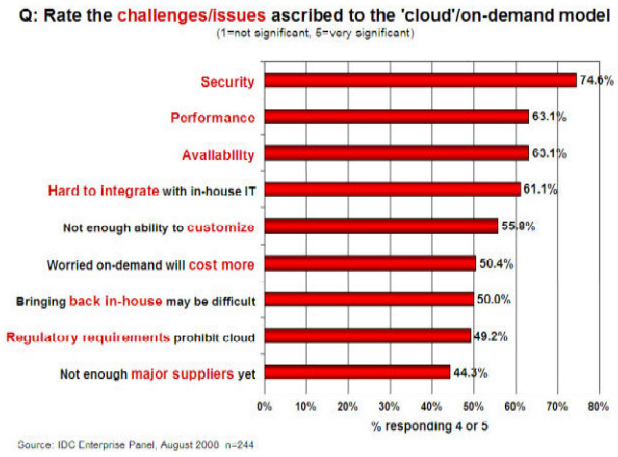

Figure 1. Challenges anticipated from adoption of cloud computing

IV. CONCLUSION

Cloud computing paradigm is still relatively young in terms of maturity and adoption. The expectation is that it will undergo several changes in the future, in terms of resources, issues, risks, and ultimately best practices and standards. However, there are some sought advantages that it can potentially provide value for institutions of higher education. On-demand services can resonate positively with the current university tight budgets across the nation and other parts of the world. Several benefits of the transition to cloud computing were pointed out in this paper along with concerns regarding the general implementation. The key question remains whether or not it makes sense from a business and strategic point of view to move to cloud computing and the answer is that it depends on various factors that were mentioned above.

One main conclusion that we draw from this research is that cloud computing may have considerable potential in improving the IT application and infrastructure at higher education institutions. However, since this field is still relatively young, it is strongly recommended that early adopters plan the transition carefully and keep in close contact with organizations that establish industry standards, such as NIST, in order to ensure a uniform and smooth transition. Another outcome is that it may be practical to follow a hybrid approach whereby, depending on the evaluation of the factors outlined above, university IT management and administration may decide to pursue a hybrid approach thus transitioning some application and data to cloud computing while leaving others to be served in-house. This should be based on a cost-benefit analysis study that follows an approach, which evaluates the real business needs. Adopters should also explore the possibility of pursuing a phased approach that is commensurate with the university's strategic direction and in concert with various Departments of the university. One final recommendation, especially for public universities that receive government funding, is to explore a nation-wide cloud computing offering for higher education institutions that is federally funded. This would ensure that adequate funding is furnished for further research that addresses the concerns raised earlier while encouraging the collaboration across various universities along with official institutions such as NIST and the establishment of standards that would lead to the maturity of cloud computing and its proper adoptions across the industry and academia. the information assurance program at the School of Technology Studies at Eastern Michigan University plans to perform further qualitative as well as quantitative research in the future in order to evaluate the impact of transitioning to cloud computing.

V. REFERENCES

[1.] Dawson, Catherine: *Practical ResearchMethods*: UBS Publishers 'Distributors, New Delhi: 2002.

[2.] Amazon, (2009). "Amazon Elastic compute Cloud." Retrieved from http://aws.amazon.com/ec2/, on August 28, 2009.

[3.] Armbrust, Michael, Armando Fox, et al. (2009). "Above the Clouds: A Berkeley View of Cloud Computing." Technical Report No. UCB/EECS-2009-28, Electrical Engineering and Computer Sciences, University of California at Berkeley. Retrieved from http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf, on August 31, 2009.

[4.] Creeger, Mache (2009). "Cloud Computing: An Overview." ACM Queue, Association for Computing Machinery.Katz, Richard, Philip J. Goldstein, and Ronald Yanosky.

[5.] "Demystifying Cloud Computing for Higher Education" (Research Bulletin, Issue 19). Boulder, CO: EDUCAUSE Center for Applied Research, 2009. Retrieved from http://www.educause.edu/ecar, on October 9, 2009.

[6.] Mell, Peter and Tim Grance (2009). "Draft NIST Working Definition of Cloud Computing." Retrieved from http://csrc.nist.gov/groups/SNS/cloudcomputing/cloud-def-v15.doc, on August 28, 2009.

[7.] NIST, (2009). "Presentation on Effectively Gruman, Galen (2008-04-07). "What Cloud computing really means". http://www.infoworld.com/d/clou/dcomputing what-cloud-computing- really-means-

[8.] "Cloud Computing: Clash of the clouds". www.economist.com/displaystory